In [131]:

```
import matplotlib.pyplot as plt
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
from pylab import *
from mpl_toolkits.mplot3d import Axes3D
from scipy.stats import *
import scipy.integrate as integrate
```

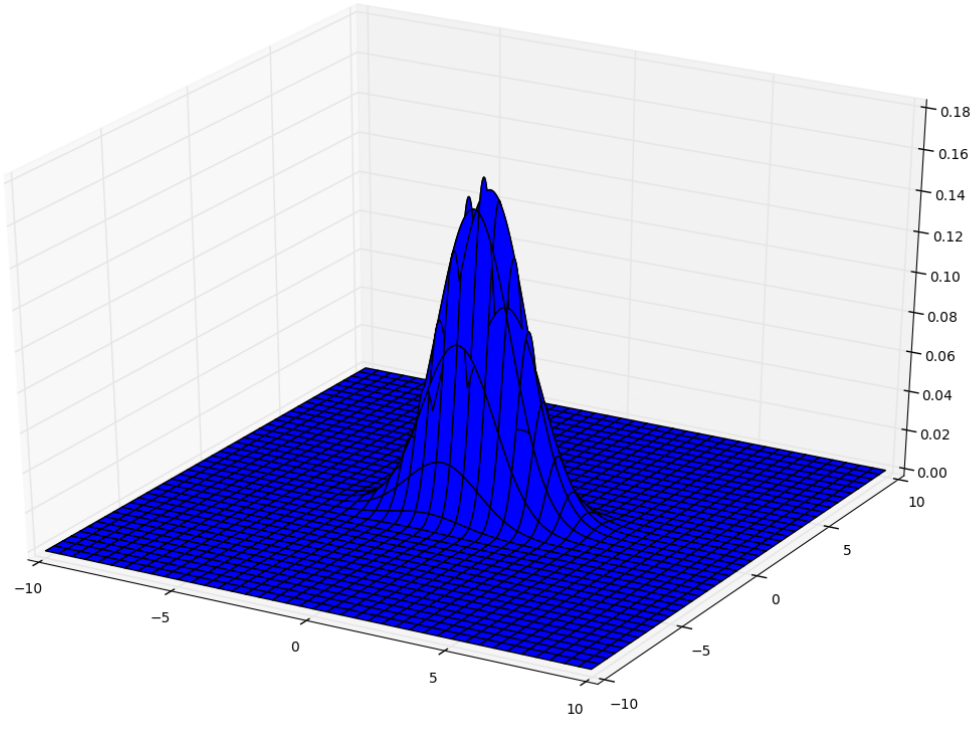
Построение графика совместной плотности

In [93]:

```
#матрица ковариаций
cov_matrix = [[10, 8],
              [8, 10]]
#вектор матожей
a = [1, 4]
distr = multivariate_normal(a, cov_matrix, (3, 3))
```

In [105]:

```
x, y = np.mgrid[-10:10:.05, -10:10:.05]
pos = np.empty(x.shape + (2,)) #сетка
pos[:, :, 0] = x; pos[:, :, 1] = y
fig = plt.figure(figsize=(15,10))
ax = fig.gca(projection='3d')
ax.plot_surface(x, y, rv.pdf([pos]),  shade=False)
plt.show()
```

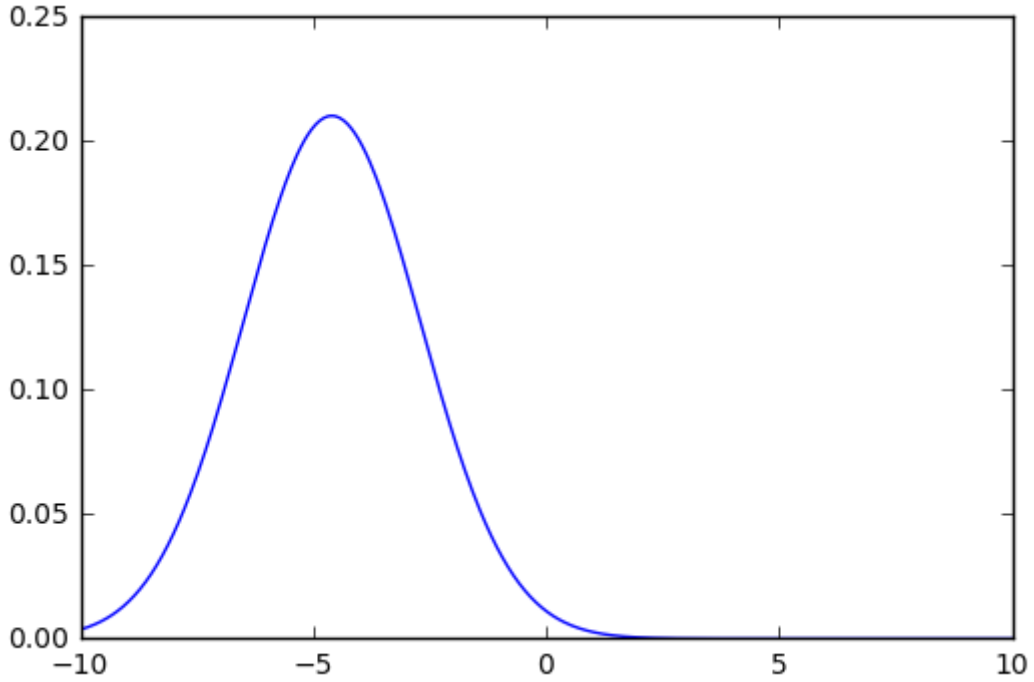


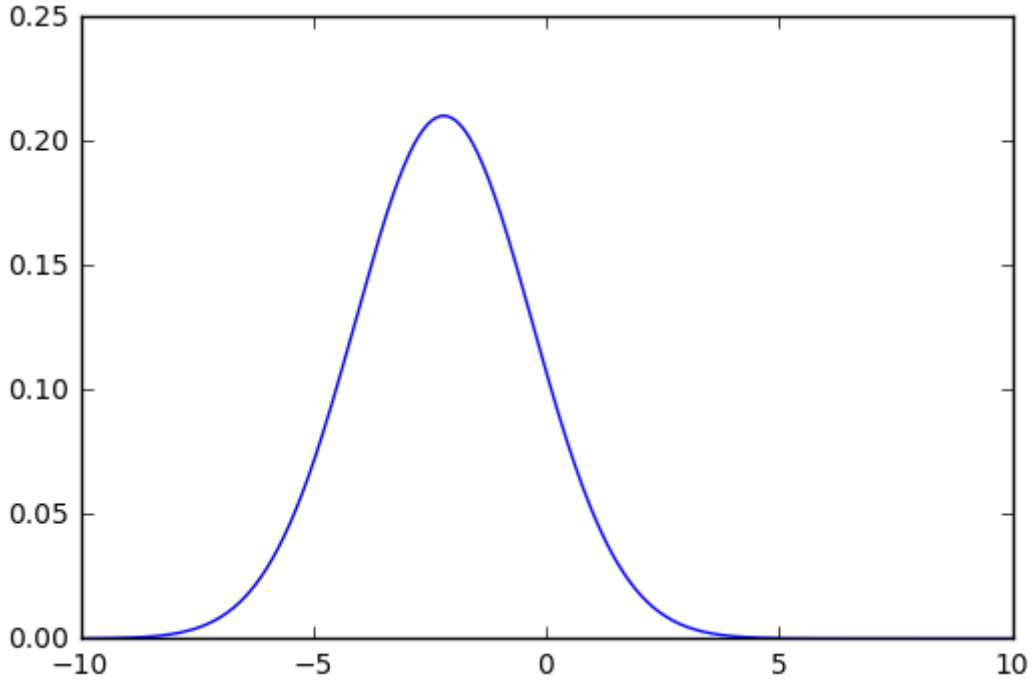
In [101]:

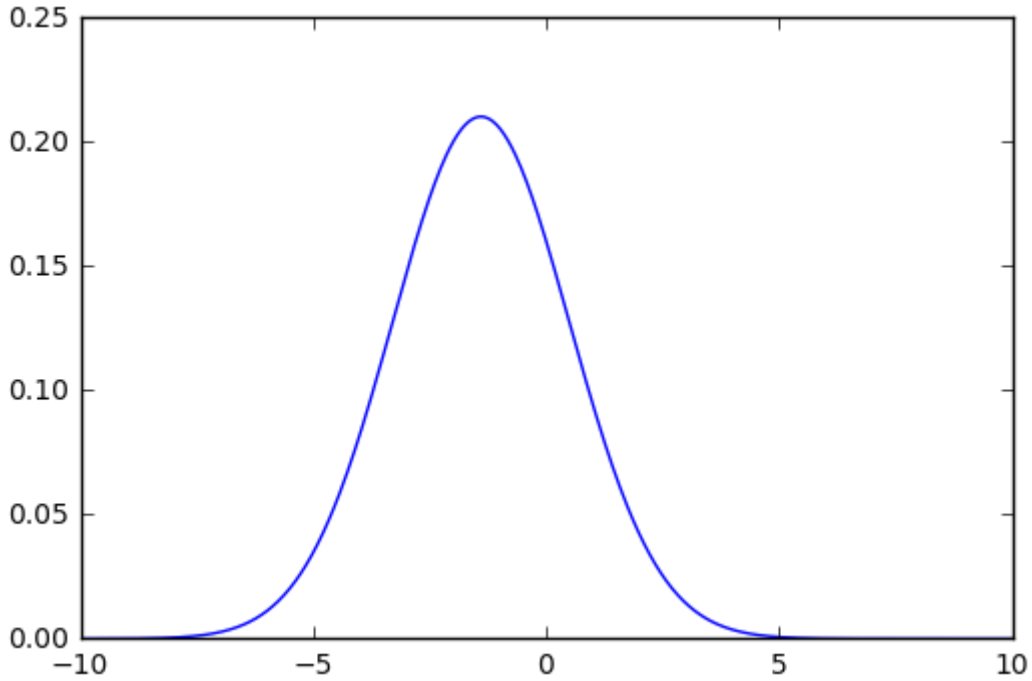
```
# Условная плотность
def cond_distr(x, y, a, cov_matrix):
    return multivariate_normal.pdf([x,y], a, cov_matrix) / (norm.pdf(y, loc=a[1], s
```

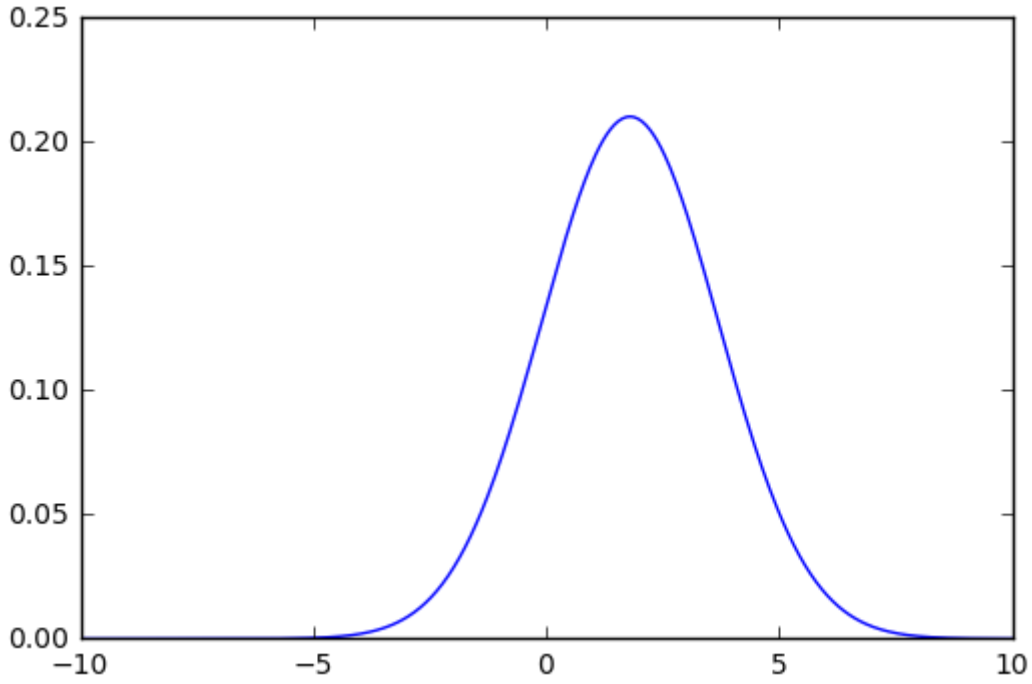
In [130]:

```
y_arr = [-3,0,1,5]
bins = linspace(-10, 10, 500)
# Графики условной плотности
for i in range(len(set_of_y)):
    plt.figure()
    distr_tmp = []
    for x in bins:
        distr_tmp += [cond_distr(x,y_arr[i],a,cov_matrix)]
    plot(bins, distr_tmp)
plt.show()
```









In [139]:

```
# Условное матожидание
def E(y, a, cov_matrix):
    return (integrate.quad(lambda x: x * cond_distr(x, y, a, cov_matrix),-10,10))[0
```

In [168]:

```
plt.figure()
xlabel('Y')
xlim(-8,8)
plt.scatter(y_arr[0], E(y_arr[0], a, cov_matrix), color='g')
plt.scatter(y_arr[1], E(y_arr[1], a, cov_matrix), color='r')
plt.scatter(y_arr[2], E(y_arr[2], a, cov_matrix), color='black')
plt.scatter(y_arr[3], E(y_arr[3], a, cov_matrix), color='orange')
plt.plot([-8,8],[1,1], color='blue', label="s")
plt.show()
```